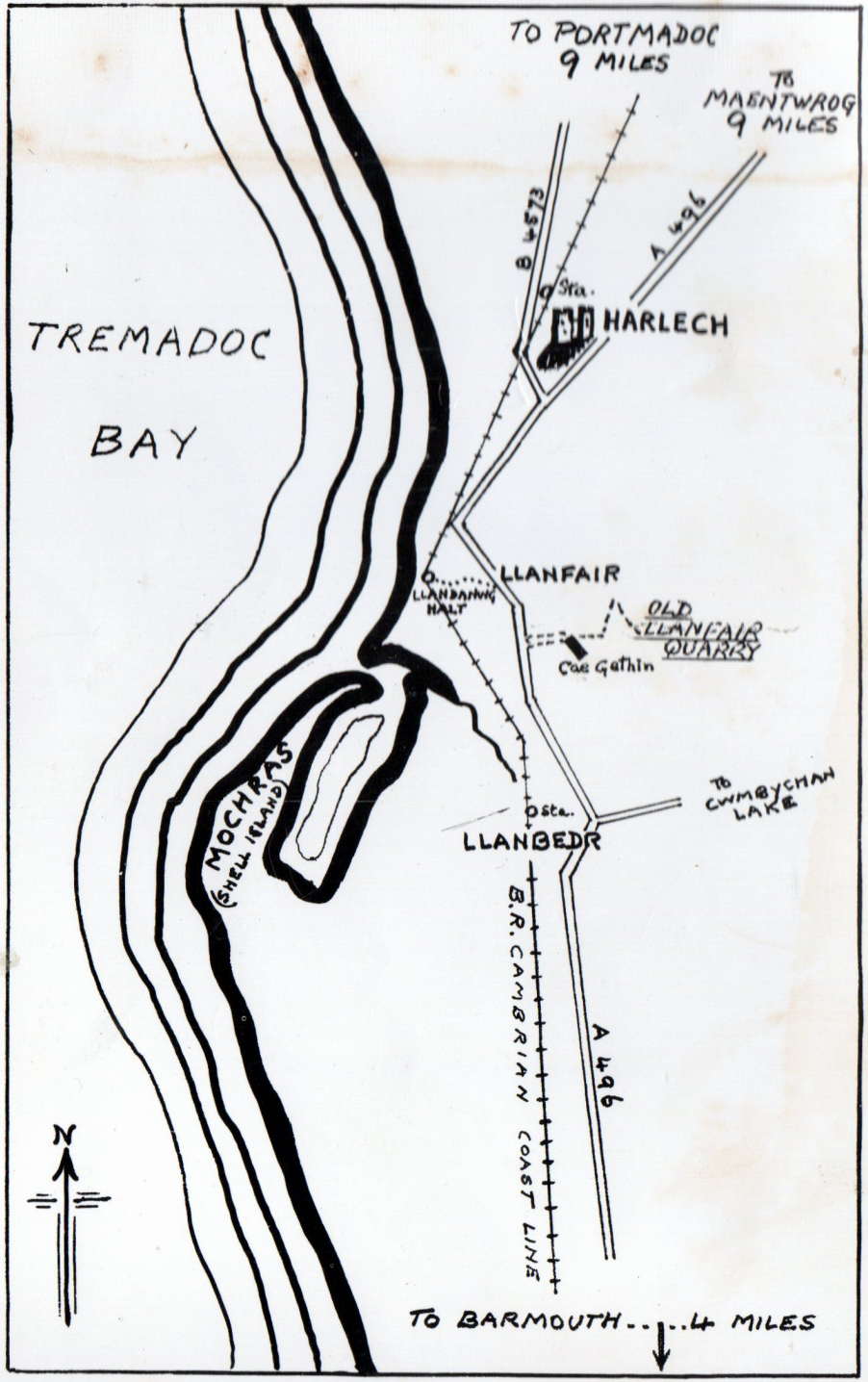

CHWAREL HÊN LLANFAIR

OLD LLANFAIR QUARRY

SLATE CAVERNS

SOUVENIR GUIDE

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CHWAREL HÊN LLANFAIR
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SLATE CAVERNS

CAE GETHIN
LLANFAIR, HARLECH
MERIONETH

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The sketches of Chwarel Hên are by Tony Knight

1. INTRODUCTION TO CHWAREL HÊN

THE PLACE AND ITS STORY

"Chwarel Hên Llanfair" the folk of Ardudwy call it—*Chwarel* is Welsh for "quarry" and *hên* means "old". It's nearly a century old, for it was first opened in 1877, the year in which the 58-year-old Queen Victoria was declared Empress of India. The slate industry of North Wales was then at the peak of its prosperity, and Chwarel Hên was worked for thirty years until its closure in 1906.

As you drive northward up the coast road from Barmouth, towards Harlech and Portmadoc, the spoil-heaps of the Llanfair Quarry are seen on the right just before you enter the tiny village of Llanfair 8½ miles from Barmouth. They are on the face of the rocky hillside above the meadows of the ancient farm of Cae Gethin (Gethin's Field) and are much less of an eyesore than most quarry spoil-heaps because the quarry itelf is *inside* the hill—properly speaking, in fact, it is a slate mine. And this slate mine is in a unique position. Nowhere else in North Wales can the visitor emerge from spectacular caverns in the heart of the rock to find himself confronting one of the grandest sea views of the Cambrian coast.

The slate of North Wales has been used in a desultory fashion since prehistoric times. The Romans, who are known to have made use of slate when it was handy, certainly used it occasionally for roofing during their occupation of Wales. Slate quarrying on a large scale, however, didn't begin until the 1780's, when the Industrial Revolution and subsequent building expansion created a big demand for roofing slates in England. The Penrhyn and Dinorwic quarries, at Bethesda and Llanberis, were the first to take full advantage of the opportunity, and these were true quarries, cutting the slate from open workings on the face of the mountainsides. In Cearnarvonshire the great slate beds lie vertically, or nearly so, whereas in Merioneth the beds are more horizontal than vertical and penetrate deep into the rock of the hills. When the big Ffestiniog slate mines began working they had to follow the slate veins far underground, excavating huge subterranean chambers. The boom in slate mining caused more mines to be opened in Merionethshire, sometimes by a comparatively small number of men who banded themselves together to try and make their fortunes. One such mine was the old Llanfair Quarry.

Cae Gethin farm was in existence long before the slate boom began. People were living here as far back as 1640 (when King Charles the First

was on the throne) and probably before then. In 1877 some enterprising local men prospected the face of slatey rock that outcropped on the hillside above Cae Gethin, arranged a rental with the owner of the farm land, and started work. As with so many other undertakings of the kind, the records of the Llanfair Quarry were burned when it ceased to function, but it's known that in addition to men from Llanfair and neighbourhood the new enterprise included two Cornishmen and two Canadians. (The graves of the Cornishmen can be seen in Llanfair churchyard.) Quite probably these were skilled miners attracted by the slate boom to North Wales and travelling on a schooner home-bound to Portmadoc or Pensarn.

Nowadays it's difficult to imagine the little North Wales ports as the busy places they were a hundred years ago. When you look outward from the Llanfair Quarry entrance today you see an empty blue sea, with possibly a little pleasure-yacht or two sailing close inshore. But in 1877 you would have seen the white sails of coasting brigs and ocean-going schooners passing every day. In that year alone more than 200 vessels sailed from Portmadoc outward bound with cargoes of slate, many of them to cross the Atlantic and others to discharge at the Baltic ports or Hamburg. Incidentally, Labrador was often the destination of the ocean-going Welsh schooners, and it may be that the two Canadians who worked in Chwarel Llanfair originated from that coast. The smaller ships plying to European ports at that time were able to get into the little estuary of the River Artro, past the northern tip of Mochras, and come alongside the quay at Pensarn; the quay is still there, as you can see, and the stone warehouses where cargoes were stored. This was one of the reasons why the Llanfair quarry was able to succeed without a backing of capital from some rich outsider. Instead of the many miles of difficult country which the slate product from other quarries had to traverse, there was here less than a mile between the slate mine and the vital sea transport.

So the hard and sometimes dangerous work of extracting the slate began, and continued for three decades. Before looking at the old mine caverns in detail, it may be useful to glance briefly at the origin of the slate beds and at the old methods of mining and quarrying slate.

HOW DID THE SLATE GET THERE?

This is a matter of Geology. But here it will be very-much-simplified Geology, so (unless you're a learned Geologist) please don't skip it.

To begin with, you have to get ready to think in millions of years. Some of the Earth's rocks are known to be 1,500 million years old. The Ordovician rock of this hillside above Llanfair is roughly 500 million years old, and so is the vein or bed of slate that lies in the middle of it like the meat in a beef sandwich. When you touch the pillar that divides the "Crypt," at the end of the entrance tunnel, you touch something at least 500 million years older than yourself.

These rocks are Sedimentary rocks, which means that they began as a

sediment of very fine particles deposited on the sea-bottom in layer upon layer through countless centuries, when the whole of Britain was part of an ocean floor. Earth movements, volcanic upheavals, uprisings and subsidences, Ice Ages—all had to take place before the surface of the Earth began to look at all like the world we know. But the great Earth movement which is important to the slate miner happened about 100 million years ago. In this part of the world it took the form of an enormous pressure, exerted not from above or below but sideways, horizontally. If you place your hands flat on each end of a doormat and force them towards each other the mat humps up into folds. That's what happened to the Sedimentary layers, which had long ago solidified into rock.

The slate which had been formed by this solidifying was a fine-grain rock, and as it had been laid down in succesive layers you'd naturally expect it to split in horizontal sheets, rather like a pack of cards. But the incredible pressure of the Earth movement squeezed and rearranged the very particles of the slate rock, forcing the infinitesimal grains to align themselves with their longer sides up-and-down instead of across. (To get a good idea of why this happened, spread a lot of paper-clips on a flat table-top and push them inward from either side with the edges of books.) The result was that the slate, instead of tending to split along the horizontal or bedding plane, now tended to split more vertically in thin and regular sheets—a tendency called "slaty cleavage" by geologists. The buckling or folding of the slate beds caused them, as might be expected, to crack across, making what are called "natural joints".

Of course, the colossal squeeze of the Earth movement affected different beds of slate in slightly different ways, according to how they were lying in relation to the direction of pressure. Some North Wales slate can be split into smooth sheets as thin as one-sixteenth of an inch, or even thinner, while slate from another district can only be split into thicker sheets. In one region the pressure-folding may have caused natural joints very close together, so that the blocks extracted by the rockmen are too small for making the larger and higher-priced roofing slates; in another. the joints could be too far apart, which makes it more difficult and expensive to get the blocks out. In the Old Llanfair Quarry the material extracted was not top quality, but came in a handy size for ordinary roofing slates.

HOW THE SLATE WAS WON

The veins of slate uncovered by the first prospectors were of varying thickness. The principal slate bed in the Ffestiniog district is 120 feet thick in places, and there are others from 30 to 70 feet thick. The Merioneth beds were tilted downward in the mountainside (angle of dip) at between 20 and 30 degrees, in a north or north-west direction. The first operation was to get alongside the slate bed by driving an adit or incline through the rock so as to reach the upper surface of the slate where it met the rock above. Then the first "level" would be driven out sideways above the surface of the

slate. The plan of work was to make a series of parallel chambers across the slate bed, and because there was a limit to the safe span of the rock ceiling it had to be supported at intervals. Wide pillars, or walls, were left as supports between the chambers—often, when the upper rock was not too firm, nearly as wide as the chambers themselves. When the second level came to be driven, perhaps 50 feet below the first, it was essential that the walls of its chambers should be directly under the walls of the first-level chambers.

Once the level had been opened under the rock ceiling of a chamber, the next step was to carve out an inclined drift, called a "roof," up one side of the proposed chamber. The roof would be about 4 feet wide and 4 feet high. (There is an excellent example of this in the small chamber of Chwarel Llanfair numbered 4 on the Plan.) The sideways widening of the chamber was continued until it was 40 or 50 feet wide, and this would go on at the same time as the excavation of the roof, so as to increase the air space as quickly as possible. At this point the atmosphere in the workings was laden with slate dust and breathing was difficult.

All the work done so far was done by the "miners", whose job was quite distinct from that of the "rockmen" or slate-getters. Now the rockmen took over, while the miners went on with their work of driving levels, roofing-up, and widening other chambers.

The rockmen first of all examined very carefully the hard rock above the new chamber, which should have been left perfectly secure by the miners; as they might have to work beneath it for ten years or more they were naturally keen to make sure that all doubtful flakes or other possibilities of a rock-fall had been removed. This done, they proceeded to break ground. The slanting corridor of the "roof" made it easier to begin this process. Efficient power drills had not yet been invented, and a simple tool called a "jumper" was used for boring holes. (One can be seen in Chwarel Hên.) It was a long rod of iron tipped with chisel ends of forged steel, with a thickening to give weight and impetus near one end. The hole was begun using the short end, striking it against the rock and giving a slight twist at each stroke; when the hole got deep enough the long end was used. Then the gunpowder was inserted and tamped down and the protruding fuse lit. The charge was sufficient to produce a rending-away of the slate block, which could then be levered clear for transporting out of the mine.

Light narrow-gauge rails would be laid as soon as possible in the levels, with small wagons running on them, first for the quick removal of the rock rubble excavated by the miners, and afterwards extending along the levels as these developed, for the transporting of slate. Two men could handle a loaded wagon along the flat, but on the inclines between levels a winch had to be used, usually hand-operated. When the trucks reached the top level they would have to descend a steep incline outside the mine, and on this a pulley system would be rigged so that laden trucks descend-

ing hauled up empty trucks on a parallel track. Below this a much gentler incline, or a level stretch of line, would lead to the cutting sheds.

The cutting of the slate into its usable forms involved the use of machinery. Sometimes the power for this was supplied by a big water-wheel, especially in the smaller and remoter quarries, but many—and the Llanfair Quarry was among them—powered their driving-belts with a steam-engine. For the roofing slates, however, the slitting into thin sheets was always done by hand and the man who did it was a skilled craftsman.

The blocks coming from the mine were first cut up by a rotary saw, crosswise, the man at the sawing bench ensuring that they were cut to the required sizes. Next they were passed to the craftsman with mallet and broad-bladed chisel, who—by placing his blade parallel to the cleavage line—could split off the thin slates for roofing use with unerring accuracy and amazing rapidity. No machine was ever evolved to substitute for human skill in this operation.

In the old photograph, taken inside the cutting shed at Llanfair about 1900 and the only one discoverable, you can probably make out two "dressers" at work splitting slabs into slates, using the *cŷn manhollt* or broad chisel which is struck with the *gordd y wal*, in this case a wooden mallet strengthened with iron bands, though iron mallets were sometimes used. The dresser sits on a wooden stool or block which he always called his *blocyn tîn* (I'm afraid the only exact translation of this is "bum-block") with the slab resting against his thigh, so that a leg as well as two hands plays its part in determining the accuracy of his work. To protect his

trousers he has a piece of sacking or old carpet between slab and thigh, called *carped glîn*. The two standing men in the photograph are trimming the slates to precise size with the aid of rotary blades, and the one in the background is holding a Lady in his hands—a Lady, that is, measuring 16 inches by 8 inches. From Ladies of this size, roofing slates went up through the larger sizes of Viscountesses, Countesses, Marchionesses, Small Duchesses, and Duchesses to Princesses measuring 24 inches by 14 inches.

When they had been graded for quality and sorted into sizes the slates from Llanfair Quarry were loaded onto horse-drawn wagons and taken down to the quay at Pensarn for shipment. In the old warehouse on the quay you can see a picture of the *Elizabeth Richards*, one of the sailing-ships that transported the slates. Her cargo when she returned after disposing of the slates was often seed-potatoes, which were much needed by the Ardudwy farmers.

Meanwhile, the work of winning the slate inside the mine became harder as the years went on and the chambers grew bigger. While the slate wall at the foot of the sloping vein could be reached from the floor the drilling and splitting-off was straightforward work, but as it was cut back its height increased so that ladders had to be used, uneasy stances while wielding the jumper or mallet and wedge. Sometimes ledges were left for foothold and the rockman would secure himself by driving in an iron peg and fastening a length of chain to it; with the chain round his thigh in a half-hitch he was reasonably protected against a fall and had both hands free for his work.

Electric lighting had not come into general use when Llanfair Quarry was working. The miners and rockmen worked by candle-light, and the candles they used were by no means as neat and efficient as the wax candles of today which we keep handy in case of "power cuts". The old slate miner's candle, which he often made himself, was simply a length of cotton string dipped repeatedly into mutton-fat. He would arrive at work with half-a-dozen of them, their wicks tied together and looped over a button of his jacket. The smell when two or three of these were burning and smoking in the restricted space of a newly-started chamber can be imagined. The Merioneth slate miners used to stick their candles to the rock wall with a dollop of clayey substance which they called "Talsarnau mud"; balls of this stuff are sometimes found in long-disused mines. The source of Talsarnau mud was kept secret, so greatly was it valued as candle-"stick", but it's known to be somewhere near the shore of Ynys, a mile west of Talsarnau.

In most cases a certain amount of daylight entered, after a time, to assist the candles. As you will see inside Chwarel Hên Llanfair, large openings were made when possible to increase ventilation, and the "roofs" with which new lower-level chambers began were eventually cut right through into the level above. When the chambers of the upper level were finally

worked out and their vast spaces empty, some light at least could get down to the lower level from their ventilation openings. And when the acetylene lamp came into use later on the miner was better able to see what he was doing in the dark lower levels.

When Chwarel Hên Llanfair was in full production forty men worked there. The method of payment was one peculiar to the slate industry: a "partnership" of four men formed a semi-independent unit, two rockmen working underground at getting the slate and two men above ground making it into merchantable goods. At the end of the month the stock of each partnership was counted and the men credited according to their "make" on a fixed tariff. This was because the yield or slate from any given block depended largely on the skill of the dressers and much of a hard-won block could be wasted by unskilled or careless dressing; the partnership arrangement ensured that the dressers did their best to get as many good slates as possible from the block. In a month (24 working days, in 1900!) a 4-man partnership might earn about £25, from which the cost of materials supplied for their work would be deducted. Here is a typical list of deductions:

Explosives	6s. 6d.
Fuse	1s. 0d.
Smithy	5s. 11d.
	13s. 5d.

From which it will be seen that a slate miner's pay would be something like £72 a year.

Roofing slates have been mentioned as the chief product of the Llanfair Quarry. Slate was—and still is to some extent—used for other products. Thick slate slabs can be used for cisterns, billiard tables, tombstones, laboratory benches, blackboards, and mantelpieces, and are excellent as electrical switchboards—the famous liner *Queen Mary* was fitted with slate panels for this purpose. A more local use (and you can see this anywhere in North Wales where villages are near slate quarries) is for fencing; some Merioneth cottage gardens are fenced with 4-foot rectangular slabs of slate.

But rising production costs and declining demand began to act adversely on the slate industry, and soon after 1900 the smaller concerns like Chwarel Llanfair stopped work. Today the industry is virtually dead. The deserted mines and quarries remain to be visited and marvelled at, not only as impressive and scenic places but also as memorials to the toil and ingenuity of an earlier age.

2. INSIDE THE SLATE MINE

SAFETY PRECAUTIONS

When you walk into Chwarel Hên Llanfair you enter what was once a solid hillside with no natural caves in it. All the huge chambers you pass through are man-made. The miners who carved out their ceilings of rock were sound workmen—the soundness of their work was proved by the rockmen who laboured in these chambers for thirty years. So the possibility of even small fragments dropping from overhead is so remote as to be negligible, and your progress round the mine is made in perfect safety.

All the same, every person visiting the mine is required to wear a safety helmet—including the guide, who sees to it that all the guided party wear their helmets. These are authentic quarrymens' safety helmets, light and comfortable to wear, and white in colour because (obviously) it makes it easier to locate the wearer in the dimness of the lower levels. Though the strength of their scientific design is most unlikely to be tested, they do afford practical protection against the rugged roofs of the tunnels, which are rather low in some places. A proportion of the guided party will also carry lamps, issued from the store at the entrance.

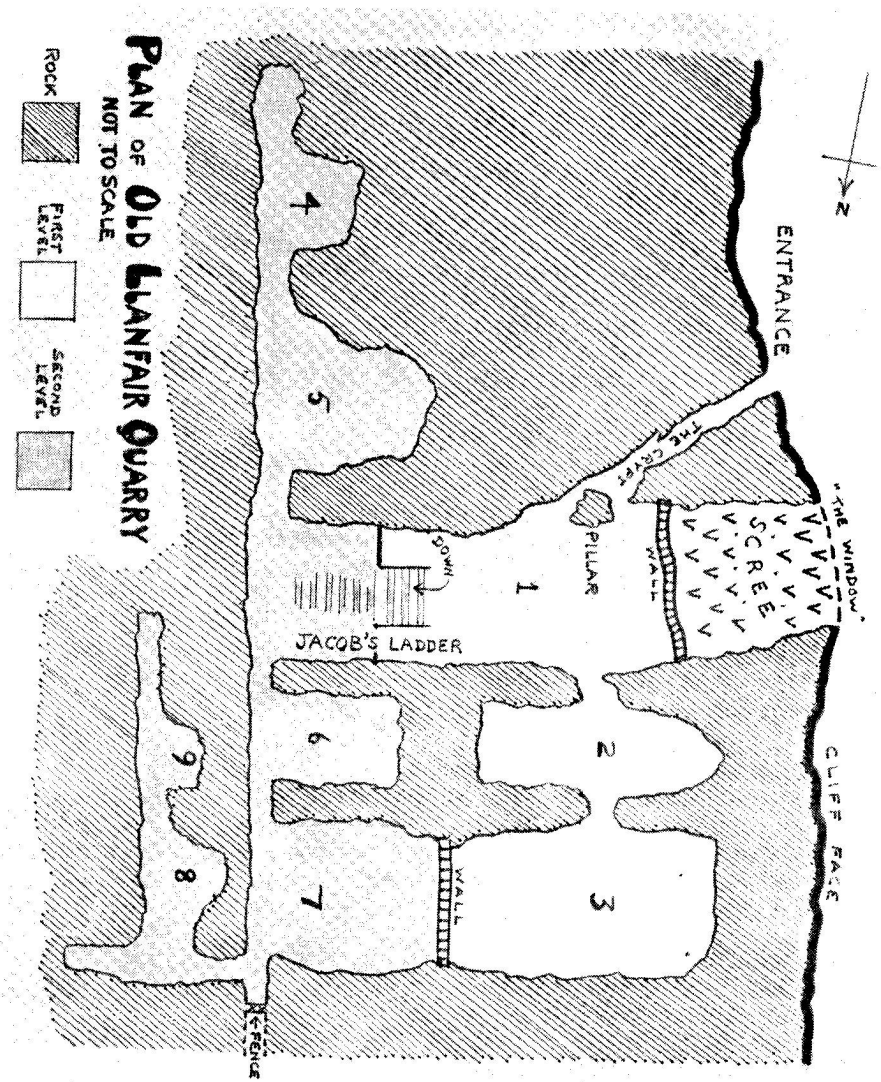
The whole mine, incidentally, receives periodic examination by Government inspectors to ensure its safety for visitors.

An Emergency Exit is provided by a tunnel at the northern limit of the second level. This is closed by a removable fence (marked on the Plan) and leads to an opening in the lower part of the hillside.

The temperature in the caverns rarely exceeds 50deg.F. This can feel cold on a warm summer day, so you are advised to wear jacket or sweater.

THE LEVELS

There were three levels in the Llanfair Quarry, descending in a slanting plane with drops of 50 to 60 feet between their eventual floors. Today the part of the quarry first entered, by way of the passage known as The Crypt, is called the first level and the one below it the second level, as named on the Plan; but the original first level, which has virtually disappeared with the removal of the slate, was above these. The entrance to it was through the opening named "The Window" on the Plan, which marks where the upper surface of the slate vein used to be. The Crypt was a later entrance to the old second level. There is another (disused) entrance farther along the outside of the hill.



CLOSED LEVELS OF OLD QUARRY

The levels extend northward in the hill for some distance beyond the part shown and comprise five more chambers. There are other workings southward in the hill. When the only surviving Llanfair quarryman began working in these as a youth, the central caverns had already been worked out. Water and rubble have made the north and south extensions inaccessible and the passages leading to them have been blocked.

THE CAVERNS

The entrance is kept closed when the caverns are not on view, and the gate that closes it—a fine example of a local welder's craft—gives access to a passage through the rock. At the inner end of it you see a dividing pillar, left to support the roof, giving the impression of a crypt beneath a church. As you approach The Crypt you pass through an outer barrier of doleritic rock—probably a geological "sill"—and then through a different sedimentary rock before entering the first of the caverns, a space once filled with slate.

On the Plan the nine caverns are numbered so that the descriptions that follow can be identified. This doesn't mean, of course, that you would visit then in that numerical order.

Cavern 1. The impression of loftiness and soaring walls that strikes you as you enter this first chamber has led to its being called "The Cathedral", an apt name in more ways than one for here at Easter the singers of Llanfair come to exercise their art in these acoustically strange surroundings. Welsh miners and quarrymen have always been noted for their singing, both at work and after work, and no doubt the levels echoed to their music long before The Cathedral took its present shape.

The big opening overhead, above a slope of scree, allows a fair amount of light to enter the chamber. This "Window", as mentioned earlier, was the original main entrance to the first level. High on the rock ceiling you'll see lichen growing; a curious substance this, composed of a mingling of fungus with algae and able to live where there is very little light. Well up in the right-hand wall as you enter is a niche, known to the Cae Gethin children as the White Owl Hole. A white owl used to nest here and may one day return. No bats are known to inhabit the caverns, and—though they are not likely to be seen—the only other inhabitants are woodlice, ladybirds, and very small red spiders.

In the floor of The Cathedral is the old turntable where the trucks were turned round. The narrow-gauge rails ran down the incline leading to the second level, just beyond, which has now been provided with a stairway of broad stone steps known as Jacob's Ladder.

Cavern 2. This chamber, next door to The Cathedral, is lit by a cleft high up in the wall which allows light from the "Window" to penetrate. On the right as you face this part the wall shows clearly the long straight grooves

made by drilling. When the "shot" was fired the rock parted cleanly here, leaving a neat half of the bore-hole in the parent rock.

Turning your back to the light, you look into the opposite half of the cavern and see a ragged slit between wall and roof. It gives ventilation and a little light to the chamber below on the second level, numbered 6 on the Plan.

Cavern 3. This is the last of the three caverns on the first level at this end of the mine, and an impressively lofty one. Two high openings give some light, and at the foot of the wall below them the rubble has been built into two walled platforms, giving an altar effect that matches well with the ecclesiastical architecture of The Cathedral.

In the opposite part of the chamber the inner wall is nearly all gone, and from the protective stone wall built across the floor you can look down into Cavern 7 on the second level, as from a balcony. You can see a shelf or platform jutting from the far wall of Cavern 7, with two pieces of rusty iron protruding from it. These are broken rails. In the days when the space below you was occupied by solid slate the narrow-gauge truck line ran across it at this level.

In the chamber wall on your left as you face the "balcony" is a charmnig example of Nature's jewellery. An incut ledge a couple of inches square displays what appears to be a small fossilized fern but is really the delicate pattern made by Dentritic Manganese, a mineral deposit. High on the roof overhead you can see the green deposits of Malachite, a carbonate of copper which has the awe-inspiring chemical formula of $CuCO_3.Cu(OH)_2$.

Cavern 4. To reach this chamber you descend Jacob's Ladder to the second level, turn right at the bottom, and go along the rock passage nearly to its end. The cavern, a comparatively small one, was evidently abandoned soon after the removal of the top blocks of the slate vein, and provides an excellent example of how the rockmen worked.

The "roof" or alleyway running up the side of the big slab of slate is here (its use was described in the first section of this booklet) and the slanting ceiling against which the vanished slate once lay shows the angle, about 30deg., of the vein's dip. Perhaps more interesting still is the bottom end of the slate slab, where on the left you can see the slaty cleavage of the rock in the obvious sheets or layers that compose it. The cleavage is not vertical to the bedding-plane, but makes a high angle with it.

Cavern 5. All the slate has been removed from this rather larger chamber. Perhaps because of the dim lighting, the smooth and lofty back wall, and the low platform that suggests an altar, it has something of the atmosphere of a Baptistery in some very ancient church. The idea has at least a small connection with fact, for the miners in Chwarel Hên came upon an underground spring hereabouts, which they called *Pwll Glas* (the Green Well) and which was used by local Baptists for their rite of baptism. In such an

awesome place it must have been a most impressive ceremony—one that the baptised ones wouldn't forget in a hurry.

Cavern 6. You pass the foot of Jacob's Ladder to arrive here. The lofty back wall runs up to a cleft where a little light enters; this is the cleft you have seen from the other side in Cavern 2. When the afternoon sunlight strikes through the "Window" in the outer hillside some of the extra light comes in through the cleft and produces a striking effect on the wall below. Then, with a little imagination, you may discern the bold features of a man many times lifesize, formed by the projecting rocks. It has been suggested that this could be a likeness of Owain Gwynedd, and it would indeed be fitting if the implements of toiling Welshmen have carved by accident a monument to this great and good Prince of North Wales. Owain Gwynedd, who ruled over these parts in the twelfth century, was the father of that Prince Madog whose discovery of America (300 years before Columbus) is believed in by many of those who have examined the evidence.

Cavern 7. Here you look up to the "balcony" that walls-in the opening of Cavern 3 above. In the cavern walls and elsewhere throughout the quarry the hewn rock displays small crinkles and irregular patterns that are sometimes taken for fossils by visitors. In fact, fossils in slate rock are so very rare as to be practically non-existent, and in the few instances where they have been identified they are distorted beyond recognition by the immense pressure to which the slate beds were subjected 100 million years ago.

From the north-east corner of this cavern the passage connecting the four larger chambers of the second level continues on its way into the closed part of the old quarry. The removable fence across it bears the notice EMERGENCY EXIT. Another passage to the right of this one leads to the two last caverns, and as you turn the corner and go along it you notice in the roof the bright red stains of iron oxide. Not far from these a faint circle of red paint with a dot in the centre marks an old survey point of the mine surveyors.

Caverns 8 and 9 are very small chambers. Being in line with 6 and 7 and with the same floor-level, they were doubtless made to get out the slate from the upper surface of the vein, whose underpart would run down below their floors. Passing out of Cavern 8 to reach the last and smallest of the chambers, look closely at the rock wall on your right. Here can be seen the shining yellow crystals of Iron Pyrites, "Fool's Gold", embedded in the rock, with other metallic crystals which are probably a sulphide of copper and iron.

The passage runs a little way beyond Cavern 9 and ends in a blank wall of rock. You return, by way of Jacob's Ladder and The Cathedral and the Crypt, from the bowels of the rock to the open air and the hillside above the sea.

3. OUTSIDE CHWAREL HÊN

FLOWERS

It may seem that Slate and Flowers have no connection, for the one can't support the other. All the same, a slate mine like Chwarel Hên Llanfair can provide a surprising amount of interest for plant-lovers, as a survey made by botanists some years ago shows.

You may have noticed lichen growing in the caverns and passages of the second level. Even small ferns struggle to establish themselves here, so vigorous is the urge of plants to live, but they succeed more often in the corners of The Cathedral where there is more light. In the entrance tunnel of the Crypt the creamy panicles of Pennywort flowers can be seen in summer, and when you have passed through the gate into daylight you find many more flowers and plants growing on the rocky walls beyond. Daisy, Dandelion, Mouse-eared Hawkweed, Pennywort, Wood Sage and Heather are among them, and Bramble and Fern join the ubiquitous mosses and lichens.

The hill that contains Chwarel Hên is a steep and craggy slope exposed to the sea winds, yet four kinds of tree—Oak, Ash, Sycamore and Hazel—grow on it, and twenty or thirty different sorts of flower may be found. The commonest of the flowers (easy to spot, but please don't pick or uproot them) are:

Bluebell	Herb Robert
Gorse	Wild Strawberry
Vetch	Germander Speedwell
Stitchwort	Dandelion
Bramble	Wild Carrot
Plantain	Daisy
Primrose	Foxglove
Wood Sage	Violet
Buttercup	Rough Hawksbit
Stonecrop	

A few plants can be found growing on the slate spoil-heaps, but these have probably rooted in small deposits of soil. Slate waste is unable to support vegetation, though experiments have been proceeding in North Wales over the past 20 years to discover some plant that will grow on it.

THE SLATE WASTE

Slate production from a mine involves a tremendous wastage of

material. Pillars or walls of slate have to be left untouched for the support of the rock ceilings, as can be seen in Chwarel Hên, which means that a large proportion of the slate vein can't be taken out. In addition, there is a considerable and unavoidable wastage in the preparation of the slate for marketing

In the days when Chwarel Hên was working it was reckoned that a good vein would yield only about 40% of the available slate in the form of blocks, and of this 66% would be wasted during the dressing processes—the cutting and shaping of the slate to a finished product. In the end, the slate miner was able to sell only between one-sixth and one-tenth of the slate he had laid bare in the chambers.

No one has computed how much slate waste is lying outside the North Wales mines and quarries but it must run into millions of tons. It could be transformed into a useful by-product if the cost of transporting and grinding it could somehow be reduced to an economic figure. Before the last war the big Penrhyn Slate Quarry at Bethesda installed crushing and grinding machinery for the production of slate "flour" and granules, as well as devices for the manufacture of concrete building blocks. The chief use of the slate flour was as a filler for bituminous coating material for prefabricated road surfaces, but it was also used as a filler for plastics, rubber, linoleum, paints, insecticides and various chemical products. But this apparently extensive use brought about no diminution at all in the size of the slate tips, for in the year 1938 only 1 per cent of the waste thrown out by the quarry during that year was utilised.

Perhaps the proposal to use granulated slate in runway construction at the Maplin Airport is the beginning of a new era in slate waste disposal. Even so, if all the new airports of the world were to adopt this material it would be many centuries before the mountainsides hidden for 150 years under the "mountains of slate" saw the sunlight once again.

A VIEW FROM "LITTLE EVEREST"

The downward path from the mine entrance, after passing the wooden chalet where the helmets are kept and where postcards and souvenirs are on sale, makes a two-leg zigzag to get down to the parked cars by Cae Gethin farm. At the corner of the zigzag you see the old quarry office; and at the foot of the path, a little distance away, is the old cutting shed, now a cow-shed. All the machinery, with all the ironwork from the mine, was taken away during the last war when scrap was in great demand. The cutting shed, by the way, was used in the 'twenties for the holding of an annual local *eisteddfod*.

As you start down the first leg of the path look out for a small path slanting up the hillside on your left. It leads in a very short ascent to the flat top of a miniature mountain known as "Little Everest"—presumably named by little mountaineers. Your reward is the view, better seen from here than from the path.

On a clear day, looking to your left, you can see for 70 miles, right to the coast of Pembroke at the southern end of Cardigan Bay. To your right, across Tremadoc Bay, the long arm of Lleyn reaches out to sea, its tip 30 miles away. You may be able to make out a tiny outline rising above the headland of Trwyn Cilan that defends the dangerous lee-shore of Hell's Mouth; this is Mynydd Enlli on Bardsey, Isle of Saints. The hills of Lleyn rise in succession along the peninsula as you "pan" farther to the right—Carn Fadrun and Yr Eifl, each with an Iron Age town on its summit, and then Gyrn Ddu and Gyrn Goch and the rest of the Clynnog hills until the nearer hillside with Llanfair village on its flanks hides the Snowdonian mountains from sight. There are 2,000 years of North Wales history in that north-western quarter, from the prehistoric dwellers on Yr Eifl through the mediaeval pilgrims to the modern resort of Pwllheli whose white houses are visible across the Bay.

But the nearer coasts were the setting for the briefer historical interlude exemplified by Chwarel Hên Llanfair. Below to the left you can see the warehouses on Pensarn quay, where the slate brigs loaded, and beyond them the little estuary and the bar at the tip of Mochras. Look at the sea four or five miles out in a direct line with Mochras, and you may see the white of troubled waters on the blue. There lies Sarn Badrig, Saint Patrick's Causeway, thought by some to be the ruin of a great embankment that once held back the sea from a whole Cantref of fertile land; Seithenyn the Drunkard, who had charge of this barrier, failed to close a wave-broken gap and so the land of Gwaelod was lost for ever. Sarn Badrig was an ever-present danger to the ships with their cargoes of slate, and some were lost on it in the sou'westerly gales.

But it's easier on a hazy day to see the gleam of far white sails out on the Bay—the ghosts of the gallant Portmadoc schooners outward bound with slates for Trieste or Fiume, for Hamburg and Bergen, for Newfoundland or even Venezuela. Likely enough, some of Chwarel Hên Llanfair's slates were carried in those schooners. And it may be that the *casa* of some rich Venezuelan is roofed with material taken from the very spot where you stood in The Cathedral, ten minutes ago. I wonder if he knows that his roof is 100 million years old.

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